

## **POOLED FUND SOLICITATION TPF 1560**

### **LTPP FORENSIC INVESTIGATIONS STAGE 2: STUDY DESCRIPTION**

---

#### **Background**

The objective of transportation pooled fund study TPF-5(332) was to perform forensic evaluations on Long-Term Pavement Performance (LTPP) test sections as they went out of service, in general accordance with the guidelines provided in the Transportation Research Board's National Cooperative Highway Research Program (NCHRP) Report 747: "Guide for Conducting Forensic Investigations of Highway Pavements."

When the referenced study commenced in 2017, there were approximately 750 active LTPP test sections. And, by the time the study was completed on June 30, 2021, forensic evaluations had been carried out on 63 test sections at 26 different locations and in 23 different states. This study yielded important benefits to the participating States including:

- Insight into the factors that produce good or poor performing pavements.
- Understanding of how LTPP data can be used to further benefit the State's pavement engineering operations.
- Demonstration of how a forensic study of a pavement test section can be carried out to be further used in the State's pavement engineering practices.

This project had the added benefit of reviewing the adequacy of the data contained in the LTPP database to explain the performance of the test sections. The study yielded many important findings that contributed to improving the LTPP data both in terms of completeness and quality.

Other key study findings included the importance of obtaining within test section thickness measurements via coring or other means and the need to interact with the appropriate State highway agency (SHA) staff, via interviews and meetings, to better understand the performance of the test sections. Having measured thickness data within the limits of the pavement area monitored – i.e., not outside of the test section – is critical to the understanding of performance. Likewise, having a clear picture of the construction, maintenance, rehabilitation, and traffic history of the test sections, which no one knows better than the respective SHA personnel, is also critical to the understanding of performance.

At present, approximately 336 active test sections in 31 states remain in the LTPP program. As these sections reach their useful life or as they are taken out-of-study for various reasons, understanding how they performed and why they performed as they did must continue to be determined through forensic review.

Given the benefits to LTPP stakeholders and the program derived from the conduct of forensic investigation of test sections going out of study, especially in terms of data completeness and quality, it is important that the forensics work continue.

#### **Objectives**

The objective of the proposed pooled fund study is to create a mechanism to allow for rapidly completing forensic evaluations of LTPP sections before going out of service. Test sections that are no longer active, but which have remained unchanged (i.e., no maintenance or rehabilitation has been applied), may also be considered for forensic evaluation. Possible reasons for carrying out the forensic evaluations include:

- Determining reasons for poor pavement performance/premature failures
- Understanding exceptional pavement performance and/or longevity
- Validating pavement performance prediction (predicted vs actual)
- Collecting data to support development and/or calibration of pavement performance prediction models
- Closing-out/conducting final investigations of experimental test sections

Ultimately, however, the primary reason for carrying out the evaluations will be to determine if the data contained in the LTPP database adequately explains the performance of the test sections and why they performed as they did.

## **Scope of Work**

The scope of work (SOW) for the proposed pooled fund study consists of the following five tasks:

1. Project management
2. Test section selection
3. Desktop studies
4. Forensic investigations
5. Final project report

Activities under Tasks 3 and 4 are to be carried out in accordance with the guidelines contained in NCHRP Report 747.

### **1. Project Management**

This task includes those management activities required for the successful conduct and completion of the project. They include:

1. Preparation and execution of project safety and management plans
2. Coordination and communications activities with lead State and members of the Technical Advisory Committee (TAC)
3. Conduct of routine project management activities, including cost control, progress reports, invoices, and contract and subcontract administration

### **2. Test Section Selection**

This task addresses the selection and approval of LTPP test sections that are to undergo forensic evaluation as part of the project. The process will consist of the following activities:

4. Communications with lead State, TAC, LTPP Program, and SHAs to:
  1. Identify candidate test sections for forensic evaluation
  2. Establish level of support LTPP and SHAs can contribute towards evaluations
  3. Coordinate forensic evaluation activities with other LTPP field activities to take advantage of traffic control and/or other support being provided by SHAs and LTPP contractors, while minimizing impact on agencies
5. For each test section, submittal of recommendation to lead State to proceed or not with preliminary investigation by means of quick review of data in the LTPP database and, as appropriate, discussions with LTPP data collection contractor (DCC). Criteria for making recommendation will include:
  1. Reason test sections is being considered
  2. Objective(s) of forensic evaluation – what is to be learnt from evaluation and how will the result(s) be used
  3. Level of support by SHA and LTPP program
  4. LTPP data availability/completeness
  5. Geographical location of test section
6. TAC decision whether to proceed with preliminary investigation.

As part of the activities under this task, a tracking lists of remaining sites will be created and routinely updated, SHAs will be contacted for updates on site status and planning action for sites about to go out of service. These activities will be done in coordination with the LTPP DCC.

### **3. Desktop Studies**

If test section is approved by the TAC under Task 2, conduct a desktop study using existing data stored in the LTPP database. This will include addressing considerations such as:

- Does data in LTPP database adequately explain performance of test section?
- Do test section performance trends appear reasonable – can they reasonably be explained?
- Does data cover complete performance cycle or is additional monitoring required to capture end point?
- Is data completeness and quality adequate to explain the performance of the test section or are there data issues?

The outcome of desktop study will be a technical memorandum detailing the desktop study and its findings, conclusions, and recommendations. With approval from the TAC, the technical memorandum will be shared with the respective SHA and interviews or meetings will be coordinated with appropriate SHA staff to go over the desktop findings, conclusions, and recommendations. Revisions and updates to the technical memorandum will be made based on input from the SHA staff.

Given the wealth of information contained in the LTPP database for each test section, it is highly possible that the Task 4 forensic investigations may not be necessary for many test sections. If required, however, a draft forensic investigation plan will be prepared under this task in accordance with Chapters 4 through 8 of NCHRP Report 747. The plan will include the following elements:

- Detailed evaluation activities
- Proposed evaluation team
- Cost estimate
- Evaluation schedule.

The draft forensic investigation plan will be reviewed by the TAC to decide whether or not to proceed with it. If approved, the forensic investigation plan will be revised and finalized based on lead State input.

In those cases where the Task 4 follow-up evaluations are not recommended, the technical memorandum prepared under this task will include a suggested coring plan to obtain within test section layer thicknesses (and perhaps address other issues based on desktop study findings), which are critical to understanding the performance of the test section. This coring plan will be discussed with the respective SHAs during the earlier referenced interviews or meetings. If SHA decides to proceed with the coring, close-out monitoring activities (distress survey, profile survey and FWD testing) will be coordinated with the LTPP DCC.

#### **4. Forensic Investigations**

Under this task order, LTPP test section investigations to obtain additional data will be carried out based upon the plans developed under Task 3. The specific activities to be carried out as part of the forensic evaluations may include the following:

- Non-destructive testing (NDT) – e.g., Falling Weight Deflectometer (FWDs) testing, Ground Penetrating Radar (GPR) surveys, and distress and profile surveys
- Destructive testing – e.g., coring and boring, trenches, test pits, dynamic cone penetrometer (DCP), AC and Portland Cement Concrete (PCC) slab removal and replacement
- Laboratory testing – microscope and scanning electron microscope analysis, CT scan, x-ray diffraction, petrographic analysis
- Data analysis and hypothesis testing
- Report preparation

The above activities will be carried in general accordance with the guidelines presented in Chapters 4 through 9 of NCHRP Report 747, and the final deliverables for each forensic investigation are:

- Updates (via attachments) to the Task 3 desktop study memorandum to include relevant data and information resulting from the Task 4 follow-up investigations
- Recommended evaluation data and information for input into the LTPP database by the FHWA-LTPP program

Drafts of the deliverables will be provided to the TAC for review and comment, and in turn, they will be finalized based on TAC input.

## **5. Final Project Report**

Under this task, a final report summarizing what was done under the project will be prepared. The report will contain the following five sections:

- Introduction – project background information on the LTPP program, NCHRP Report 747 and pooled fund study to help the reader better understand what was done in the pooled fund study and why
- LTPP Test Sections – summary of LTPP test sections receiving forensic investigations
- Test Section Investigations – one- to two-page summary information for each test section that underwent forensic evaluation as part of the pooled fund study
- Summary, Conclusions and Recommendations – major findings and conclusions from the study along with recommendations specific to the LTPP program
- References (in case more detailed information is desired)

A draft of the final report will be submitted to the TAC for review and comment and, based on the input received, the report will be revised and finalized. With permission from the TAC, the final version of the report will be provided to the FHWA-LTPP Team for inclusion in LTPP InfoPave™.

### **Summary of Requirements for Project Sponsors**

The requirements for those SHAs willing to support the proposed pooled fund study are as follows:

- Financial support for the pooled fund study
- Meeting participation on conference/web calls and in face-to-face or virtual meetings if deemed necessary
- Active collaboration/partnering with all TAC members
- Championing, within their state/organizations, the deliverables from the pooled fund

### **Estimated Project Duration**

The proposed pooled fund study is anticipated to have an initial duration of three years, with a future option to extend for up to two years based on the number of sections remaining in service, and pending funding availability.

### **Budget and Sponsorship**

The proposed pooled fund study is aiming for 10 to 15 states, each contributing a minimum of \$20,000 per year for a minimum of three years. It is anticipated that FHWA, other agencies, and industry may also participate in the pooled fund. To initiate this Stage 2 of the study a threshold budget of \$200,000 is proposed that is estimated to be outlaid as follows in order to get the study started:

1. \$25,000 - Project Management
2. \$90,000 - Desktop Studies and Tech Memoranda (estimate around 9)

3. \$75,000 - Follow-up investigations each concluding with an updated Tech Memorandum
4. \$10,000 - Final Report aligned with that prepared for the TPF5-332 LTPP study recently completed.

Depending upon commitments and obligations actually made we may be able to expand the scope for items 2 and 3.

**Comments:**

Here is a list of states that active test sections currently exist--with an appeal that they please join this pooled fund as they would benefit greatly:

1. ARIZONA
2. ARKANSAS
3. CALIFORNIA
4. COLORADO
5. FLORIDA
6. GEORGIA
7. IDAHO
8. INDIANA
9. IOWA
10. KANSAS
11. MANITOBA
12. MISSISSIPPI
13. MISSOURI
14. MONTANA
15. NEVADA
16. NEW MEXICO
17. NORTH CAROLINA
18. NORTH DAKOTA
19. OHIO
20. OKLAHOMA
21. ONTARIO
22. OREGON
23. PENNSYLVANIA
24. RHODE ISLAND
25. SOUTH CAROLINA
26. SOUTH DAKOTA
27. TEXAS
28. UTAH
29. VIRGINIA
30. WASHINGTON
31. WISCONSIN